

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

UNITED NATIONS

TRANSITIONAL ADMINISTRATION IN EAST TIMOR

**THE STUDY  
ON  
URGENT REHABILITATION PLAN  
IN  
EAST TIMOR**

*FINAL REPORT*

**VOLUME 3:      MANUAL (MAIN)**

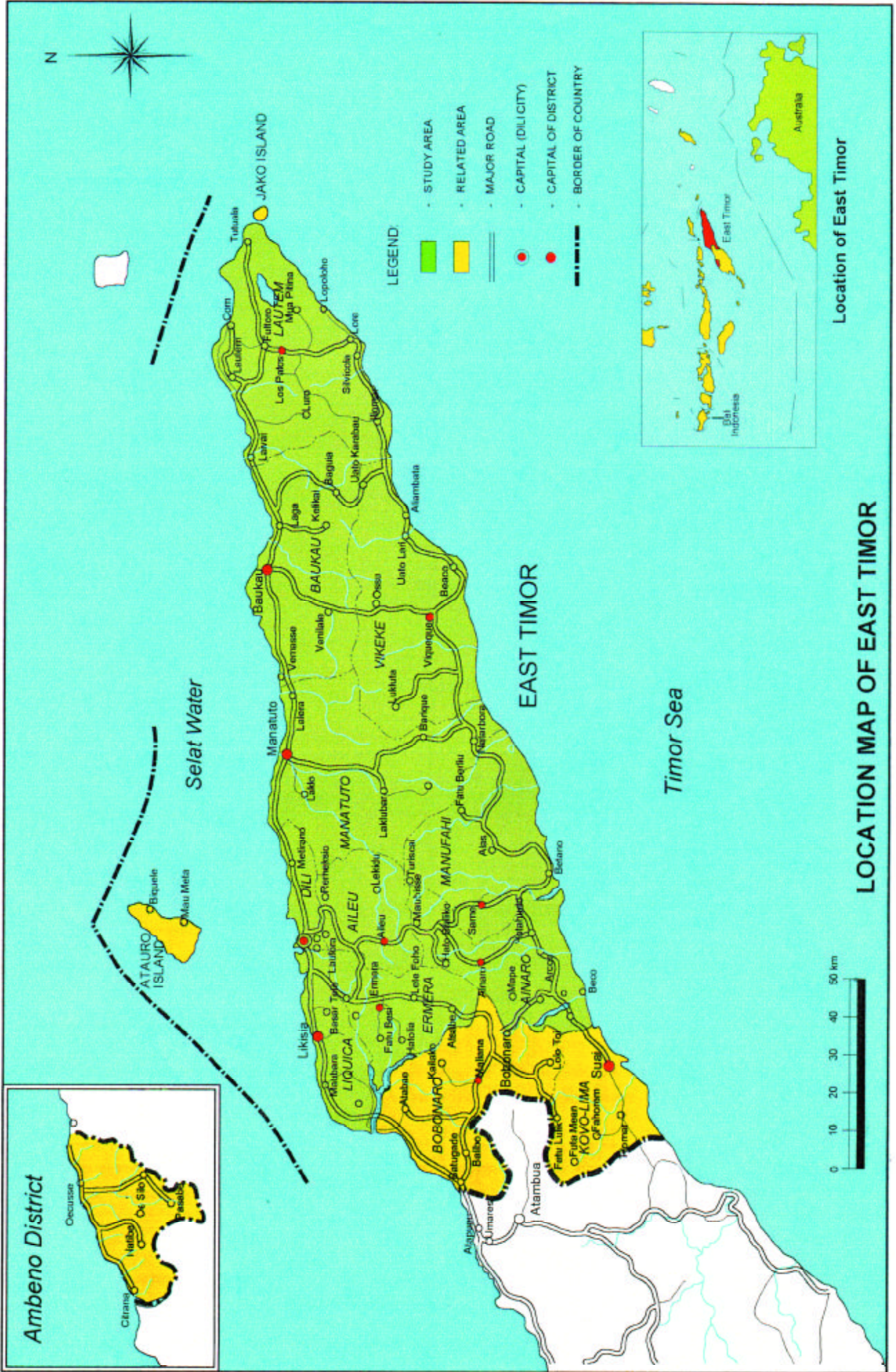
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**PACIFIC CONSULTANTS INTERNATIONAL**

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<b>J R</b>
<b>00-145</b>



**Ambeno District**



**LEGEND:**

- STUDY AREA
- RELATED AREA
- MAJOR ROAD
- CAPITAL (DILI CITY)
- CAPITAL OF DISTRICT
- BORDER OF COUNTRY



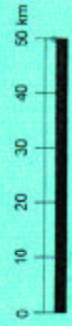
Location of East Timor

Selat Water

Timor Sea

EAST TIMOR

**LOCATION MAP OF EAST TIMOR**



**THE STUDY ON  
URGENT REHABILITATION PLAN IN EAST TIMOR**

***FINAL REPORT – SUMMARY***

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## List of Acronyms

ADB	Asian Development Bank
AusAID	Australian Agency for International Development
CAP	UN Consolidated Inter Agency Appeal for the East Timor Crisis
CEP	Community Empowerment and Local Governance Project
CFA	Central Fiscal Authority
CNRT	Conselho Nacional da Resistencia Timorese (National Council of the
D/D	Detail Design
DFID	Department for International Development (UK)
DPU	Public Works Department in Indonesia
DSRSG	Deputy Special Representative of Secretary General
DTW	Department of Transport and Works
DWT	Dead Weight Tonnage
ECHO	European Commission Humanitarian Office
EIA	Environmental Impact Assessment
EPU	Environmental Protection Unit
FAO	Food and Agricultural Organization
FY	Fiscal Year
GOJ	Government of Japan
GWT	Gross Weight Tonnage
IDA	International Development Agency
ILO	International Labor Organization
IMF	International Monetary Fund
IOM	International Organization for Migration
JAM	Joint Assessment Mission
JICA	Japan International Cooperation Agency
MOU	Memorandum of Understanding
NCC	National Consultative Council
NGOs	Non-Governmental Organization
NTG	Northern Territory Government
O/M	Operation and maintenance
OCHA	Office of the Coordination of Humanitarian Affairs
PAET	Power Authority of East Timor
PKF	Peace Keeping Force
PQ	Per-Qualification
QIPs	Quick Impact Projects
QP	Quick Project
ROW	Right of Way
S/W	Scope of Work
SRSG	Special Representative of Secretary General
TFET	World Bank-Administered Trust Fund for East Timor Timorese Resistance

UNDP	United Nations Development Programmed
UNFPA	United Nations Population Fund
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations International Children's Fund
UNOPS	United Nations Office for Project Services
UNPKF	United Peacekeeping Force
UNTAET	United Nations Transitional Administration in East Timor
USAID	United States Agency for International Development
WFP	World Food Programmed
WHO	World Health Organization
WUA	Water User Association





## **1 PLANNING GUIDELINES FOR QUICK PROJECT**

### **1.1 Introduction**

This manual generally describes the necessary work, ranging from planning to the completion of construction work, to successfully implement Quick Projects. Proper attention must be paid to the construction planning and quality control, etc. described in the manual for the planning of a Quick Project.

The contents of the manual refer to standard items under the present circumstances and their application to an actual situation must take the character of the road, contents and scale of the construction work and other relevant conditions into consideration.

### **1.2 Surveys**

The surveys to be conducted prior to construction work include a meteorological survey, geological survey, environmental survey, construction site survey and a borrow pit and spoil bank survey. For the smooth implementation of construction work, these surveys must be conducted in an appropriate manner to fully establish an accurate picture of the construction site.



### **1.2.1 Meteorological Survey**

The meteorological conditions are natural conditions which significantly affect the quality of earth work and the efficiency of construction work. Adverse meteorological conditions can render the implementation of construction work impossible or can lead to a situation in which construction work must be suspended due to the impossibility of achieving the specified work quality. Accordingly, it is essential to conduct a meteorological survey prior to the commencement of construction work so that an appropriate work plan can be formulated through proper examination of the number of workable days, etc.

- a. It is no exaggeration to say that “earth work is a battle against water” as earth work is considerably affected by water. A rainfall survey is, therefore, the most important constituent of a meteorological survey.
- b. To be more precise, the rainfall intensity and the number of rainy days in the area of the construction site in the past must be surveyed in order to infer the state of rain during the planned construction period. It is also necessary to take the topography, elevation and other conditions in the area of the construction site into consideration.
- c. The survey findings are used to examine an appropriate construction method, quality control method and schedule plan, etc. Moreover, it is essential to examine (i) the necessary for temporary trenches to drain rainwater during the construction period, (ii) safety measures to prevent the collapse of cut or banked slopes, (iii) a disposal method for outflowing muddy water from the construction site and (iv) other relevant matters in advance.
- d. When calculating the number of days when it is necessary to suspend work due to rain, it is necessary to count those days when work suspension is necessary due to a high rainfall level and the soil properties in addition to the actual number of rainy days.

### **1.2.2 Geological Survey**

The implementation of a geological survey prior to construction work is extremely important and the survey findings should be used at each of the road planning, design and construction stages. They are most frequently used at the design stage for calculation of the banking stability and soil pressure vis-a-vis the structure and also for the planning of measures to combat soft ground. During the soil survey, the topographical as well as geological characteristics of the subject area of the construction work must be identified through field reconnaissance and the gathering of existing data. Special attention must be paid to landslide areas, areas of frequent slope failures, areas with soft ground and faults.

### **1.2.3 Environmental Surveys**

Depending on the type of construction work, it is necessary to prepare measures to prevent pollution which is associated with construction work and which may have adverse impacts on the living environment around the construction site. The main types of pollution caused by construction work are noise, vibration, dust, deformation of the nearby ground, water contamination and traffic disruption. Although the occurrence of many of these is restricted by place and/or time, they can be very serious problems for

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local residents. Accordingly, it is important to not only abide by pollution control regulations but also to implement measures designed to minimise adverse impacts when conducting construction work. The relevant survey and analysis items are listed below.

- a. Laws and regulations for pollution control and environmental conservation
- b. Conditions of houses and facilities in the neighboring area
- c. Conditions of groundwater, drinking water and agricultural water, etc.

#### **1.2.4 Construction Site Surveys**

The implementation of several surveys is necessary in related to the construction site as listed below.

- a. Survey on obstacles at the site
- b. Survey on structures, etc. crossing the site
- c. Survey on laws and ordinances, etc. relating to the site
- d. Survey on buried cultural assets
- e. Survey on work road construction

Each of the above surveys pertains to extremely important matters for the people concerned and must be very carefully conducted. A sufficiently long period must be allowed for consultations with the relevant organizations to the subjects of the above surveys.

#### **1.2.5 Borrow Pit and Spoil Bank Surveys**

##### **(1) Borrow Pit**

When the earth work plan suggests a shortage of banking soil, such soil is obtained from a borrow pit. The most advantageous and economical borrow pit for construction work must be selected from several alternative sites based on the required soil supply volume, taking the survey findings on the topography, soil type, transportation distance, transportation route, possible compensation and reaction by the local community into consideration.

##### **(2) Spoil Bank**

The selection of a spoil bank(s) near the cutting work sites is desirable from the viewpoint of economy as this spoil bank is used for the disposal of surplus soil as well as inferior soil produced by cutting work. In the case of a spoil bank for inferior soil, the subject site(s) must be safe against the hazards of the outflow or collapse of the dumped soil during and after construction work. Possible measures to prevent such outflow or collapse should also be examined.

### **1.3 Construction Planning**

#### **1.3.1 Formulation of Construction Plan**

The formulation of a construction plan which conforms to the topographical and geological conditions of the site is necessary. However, as the actual construction work is conducted under the influence of the weather and other natural phenomena, there are many factors which could force alteration of the original construction plan.

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Construction work is also closely related to the surrounding social environment and, therefore, the work cannot proceed without taking such environment into consideration. Moreover, the work always demands an economical, swift, faultless and safe performance. As there are so many factors and constraints to be taken into consideration when conducting construction work, the formulation of an appropriate construction plan is crucial.

The key items to be included in a construction plan are listed below.

- a.** Soil volume distribution plan
- b.** Construction method, required machinery, work speed and period required for each type of work
- c.** Order and timing of each type of work and the entire schedule
- d.** Work implementation system and on-site temporary facilities plan
- e.** Site access road and other preparatory work plan
- f.** Accident prevention, safety and hygiene plan
- g.** Conservation of the surrounding environment plan

A basic construction plan is formulated by the owner at the design and estimation stage while a more detailed plan is formulated by the contractor following the signing of the contractor agreement.

### 1.3.2 Steps to Formulate Construction Plan

The steps to formulate a construction plan are shown below.

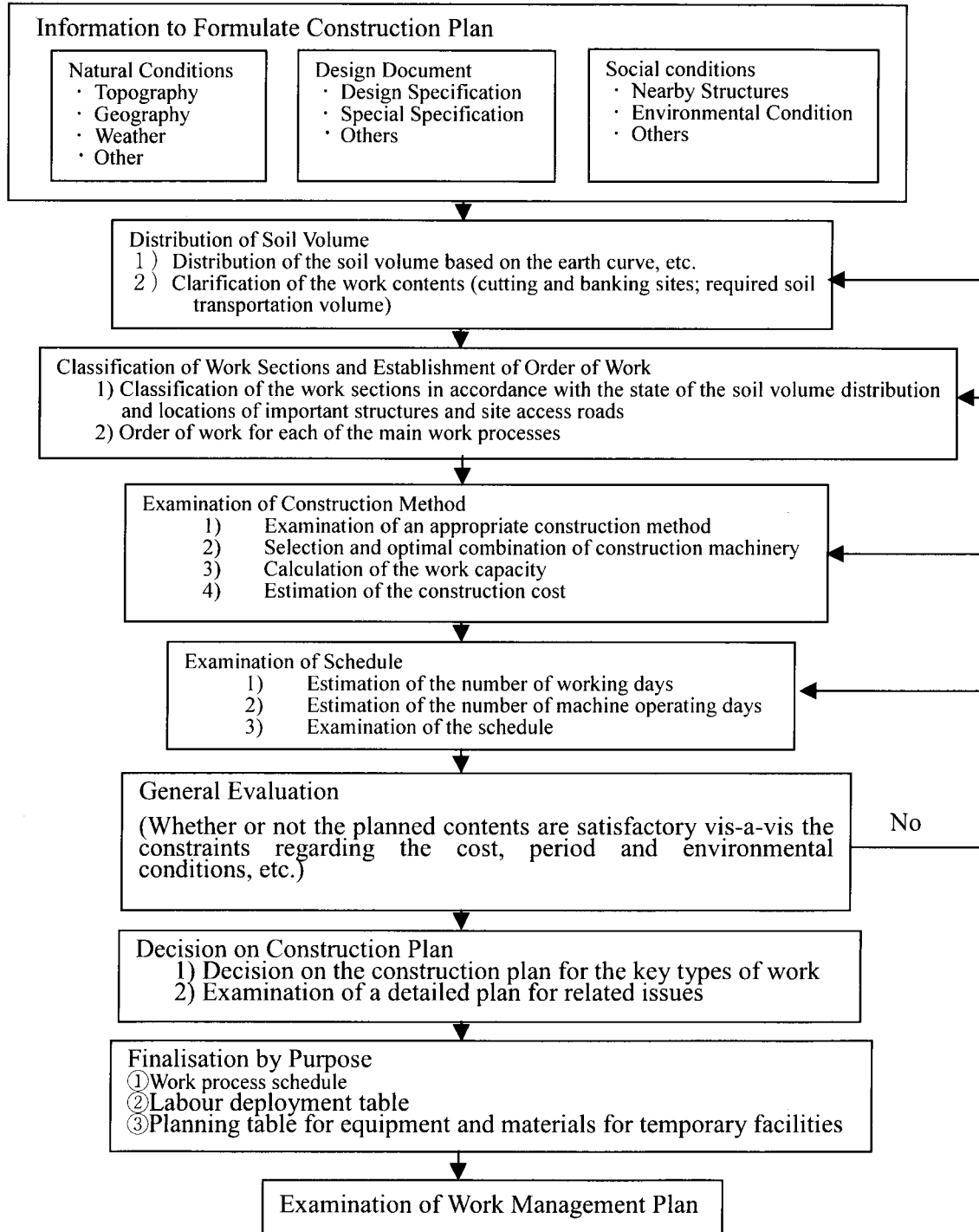


Figure 1.1 Steps to Formulate Construction Plan

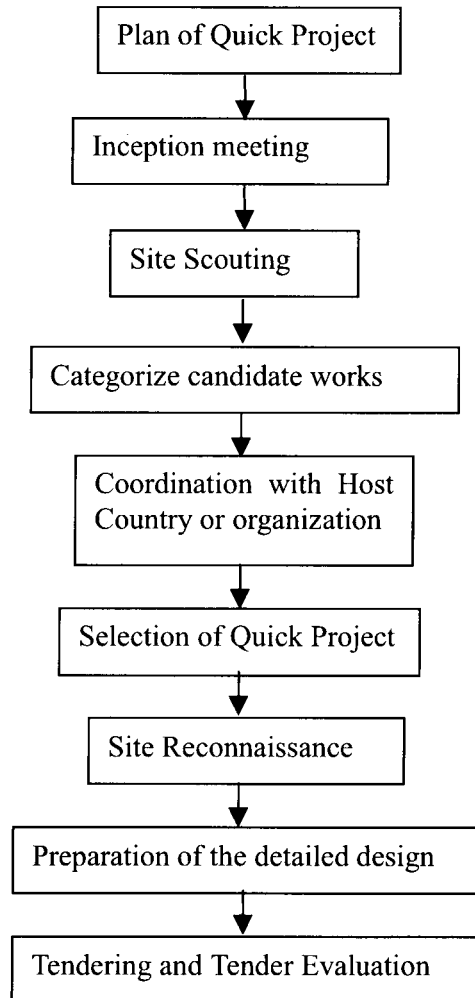
## 2 PREPARATION OF QUICK PROJECT

Quick Project is emergency support to restore the critical road in the most urgent possible time- frame. Taking into account keeping the road and bridges open as a highest priority in Host Country's program.

It is necessary to overcome many restrictions and limitations to commence the construction of Quick Project as soon as possible after entering to a confused country. The works to be done during this period are collecting various data of the country and site(s), selecting candidate(s) for Quick Project, coordination with other donors, preparation of design drawings and documents, preparation of tender documents, etc. Coordination with other relevant organizations and authorities, and obtaining approval from them shall be included within the schedule before the Quick Project implementation.

### 2.1 Quick Project Flow

Quick Project set up workflow is shown as follows



**Figure 2.1 Plan of Quick Project**

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## **2.2 Plan of Quick Project**

It is necessary before entering a confused country to collect the information concerning local conditions from the relevant authorities, organizations, pre-study team, etc. as far as possible and to prepare the countermeasure to the predictable problems.

### **(1) Condition of accommodations**

Appropriate preparation shall be made according to the information obtained for lodgings, food, water, weather, disease, transportation, etc.

### **(2) Equipment and materials to be carried in**

Required equipment and materials for the study shall be hand carried by the study team instead of sending them separately.

Procurement of vehicle for the transportation of the study team is essential. In case that procurement of vehicle is not available or difficult, it is necessary to procure from nearby country or city. Vehicle(s) shall be ready to be used on the arrival of the study team.

The map of the country, site(s), area(s), regardless of scale, shall be procured and brought in by the study team.

The electric equipment to be carried in shall be adaptable to the local voltage and local receptacle type.

### **(3) Procurement and transportation of equipment and materials**

Those equipment and materials which cannot be procured in the local market, shall be procured and transported from the nearby country or city. The important thing is to receive the equipment and materials surely on the date instructed. Chartered flight or ship shall be used whenever required.

### **(4) Procurement of living, office, transportation, construction equipment and materials**

Procurement of equipment and materials for the site survey (50m measure tapes, 5m convex, compass, portable GPS, safety shoes, gloves, field notebooks, survey tools, etc.) are essential so that the information shall be obtained in advance and countermeasure shall be taken.

### **(5) Communication and organization**

Backup system, both domestic and local, shall be organized and instruction system and communication network shall be arranged. Communication device(s) and vehicles shall be procured, and the rules and agreements for activity limitations, etc. shall be prepared. Domestic backup system and communication network shall be definitive, and the source of the information shall be unified to take the responsibility. In order to fulfill the responsibility, sufficient communication facilities shall be available and a responsible person shall be adopted.

Considering the bad road condition, 4WD vehicle(s) shall be procured.

### **(6) Procurement of Communication devices**

Satellite phone(s) (Inmarsat?), mobile phone(s), radio(s), etc. shall be procured and the members shall be well aware of the usage of the devices. Users manual shall be always carried with the devices. The communication devices shall be tested in advance of the departure or at the time of procurement. Attention to be paid when inputting the pin code as the input error will cause out of order. Actual practice shall be made to be aware of the

usage of the devices.

Periodical communication shall be made. Telephone number list of all the relevant person shall be prepared and distributed to all the members and the relevant personnel.

Connection to the “Internet” in foreign countries shall follow the local practical manner.

### **2.3 Inception meeting**

Consultation with the implementation agency of the host country shall be made to confirm the scope of work and to discuss the work schedule.

Local information shall be collected from the relevant authorities and organizations.

#### **(1) Collection of local information**

In order to confirm the information obtained before departure and to collect additional and supplemental information, effort shall be made to collect local information from the relevant authorities and organizations.

After obtaining the general information during the consultation with relevant authorities, the following information shall be collected for setting up of Quick Project.

- Topographical map
- Social and economical activity
- Information of local private contractor
- Living conditions
- Availability of local equipment and materials
- Transportation method
- Price of the local equipment and materials
- Availability of personnel, labor cost

#### **(2) Understanding of problems and formulation of solution Definition of the Project Contents**

The existing facilities in the country or the area in which Quick Project is required are usually damaged by disaster or unfit for use due to lack of maintenance caused by the political and/or economical problems. The Quick Project is to rehabilitate those failure parts which are being critical to daily activities and production activities.

The target of the road Quick Project is to make or maintain the road passable, and the minimum requirements are as follows;

- To rehabilitate slip area of shoulder and travel-way in valley side,
- To rehabilitate cut slope failures by an effective low cost measure,
- To improve depressed area due to land slide,
- To restore damaged shoulders,
- To repair deteriorated and damaged pavement,
- To restore and install side-ditch at a section where is required,
- To rehabilitate cross drains including outlet and inlet,
- To repair culverts and bridges damaged,

#### **(3) Implementation system**

Numbers of donors including NGO are making their activity in the country or area where the study team shall enter based on the demand of the host organization or government. In order to set up the Quick Project effectively, coordination with implementation agency is very important. Quick Project shall be set up by close communication with the implementation agency recognizing the organization and the personnel who is responsible for each section. The implementation of the Quick Project shall be either

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direct employment or contract basis according to the local condition. Contract basis will be preferable for limited members.

**a. Direct management**

Direct management is the way of supplying equipment, material and manpower at own expense to implement the project. In this case, appropriate personnel arrangement considering their experience and ability, organization ability, backup system shall be established.

This method has a possibility to be adopted at the case of the construction in which the equipment and material are simple and few. It is not realistic, however, to adopt it by the study team considering the amount of work and productivity to set up the Quick Project such as plan, procurement of equipment and materials, transportation, management, insurance, etc. and execution instructions, equipment and materials management, labor management, safety control, etc. required during the project.

**b. Contract basis**

This the way to entrust the construction of the Quick Project to a local contractor, and dispatched consultant shall prepare tender documents, evaluate the contractor, order contract, and supervise construction.

The cooperation of a experienced local private company is necessary to find out applicable Quick Project candidates, to formulate the project, to survey and investigate, to design, to estimate the project cost, to prepare tender documents, to conduct tender, and to fulfill the procedure required to start the construction within several months.

**2.4 Site scouting**

The consultant shall try to get information concerning actual site conditions including actual social conditions through the relevant organizations such as implementation agency, etc. After obtaining the information, site scouting shall be commenced in early stage to confirm the obtained information and to recognize the actual site conditions. The site scouting shall be carried out in a rational method using the previously obtained information effectively.

The information required from the site scouting is to select the Quick Project candidates and to collect the necessary materials for setting up the project, so that simple survey will be sufficient enough.

Duration of investigation shall be two or three days, and approximate scale of the problem point shall be confirmed by using portable GPS, distance meter of vehicle, distance measured on map, distance mark post on the road, etc.

Site scouting shall be carried out not only looking the site conditions but also with a view of the possibility as the Quick Project candidate considering the information obtained from the relevant organization including other donors.

The minimum amount of work for each road links shall be roughly estimated from the results of site scouting in order to select the project candidates and evaluation.

**2.5 Categorize candidate projects**

Road hierarchy of every link shall be examined from the results of site scouting and the existing data. It is necessary to clarify which road shall be given priority as the project for normalizing the confused road network. It will be persuadable to evaluate each road links by adopting decision factors like population along the road (per unit length), traffic volume (previous data before disturbance may be adopted), influence grade to the

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production activities, accessibility to the important traffic facilities, connection with the capital city, connection between prefectures, backup route, etc. Quick Project candidates and their contents will become clear by adapting minimum work volume to the road links.

## **2.6 Coordination with Host Country or Other Aid Organizations**

The detail of the project shall be clarified and coordination with other organization shall be taken through the host country or organization. Due to the limitation of the funds, the funds from each donor may be distributed wide and shallow. Therefore, the rehabilitation of the most important route sometimes becomes insufficient.

Demarcation will be required in such cases.

### **(1) Movement of Other Aid Organization**

It is important to understand actions of other countries aid organizations and international agencies when we prepare projects. In particular, a similar plan is being prepared or implemented by an aid organization of another country, or it may be necessary to coordinate assistance with other organizations.

Recently, the role of NGOs (Non Governmental Organizations) has become more important and has been in close cooperation with ODA activities. NGOs provide more detailed assistance to each region. Therefore, cooperation with NGOs will enable us to consider more about social characteristics of the affected area. They will also play an effective role to bridge discussion and cooperation with local residents when implementing a project. We need to know more about trends of NGO activities.

### **(2) Cooperation by other organizations**

As for aid projects in developing countries, demarcation of each aid organization is often not clear. They include the World Bank, JICA (Japan), GTZ (Germany), USAID (US), CIDA (Canada), Sida (Sweden) and others, NGOs from various countries, private enterprises which deal in BOT projects, and so on. These organizations sometimes handle similar projects although their focus of activities are different.

## **2.7 Selection of Quick Project**

Based on the priority evaluation of each road link and coordination with other donors, route of Quick Project shall be selected. It shall be noticed that Quick Project is the minimum construction work to secure the road passable and further investment shall be required to secure full function road. It is important to be aware and comprehend the ongoing project executed by other donors including NGO to avoid duplicated investment when selecting the Quick Project route. It is also important in selecting the Quick Project route that the minimum work volume corresponds to the invested fund.

## **2.8 Site Reconnaissance**

After selecting the Quick Project candidate route, site reconnaissance shall be carried out for the route in detail and shall be formulate in road inventory table.

Traffic of the route can be easily interrupted by a failure of particular uncertain point. These points shall be investigated intensively.

The failure cause of these points can be categorized to the problems of road structure itself and the natural conditions such as geographical and geological conditions, precipitation, etc. Site survey shall carried out considering the countermeasure to those failure causes.

Further to the confirmation of those locations to be repaired found in site scouting, the scale of the failure shall be measured for the design data.

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### **2.9 Preparation of Drawing and Technical Specification**

Based on the collected data by site reconnaissance, the design shall be carried out for each location to be repaired and drawings and technical specifications shall be prepared.

The design shall be based on the policy that the road shall be secured to be passable and limited to those locations, which shall be repaired. The quantity of the work and construction cost shall be estimated from the design drawings.

### **2.10 Preparation of Tendering and Tender Evaluation**

Based on the design drawings and technical specifications, tender documents shall be prepared and clarify the each work item, which shall be fulfilled in the contract.

Tender shall be called by selecting pre-qualified contractors and pre-bid meeting. Contract negotiation shall be made with the awarded contractor after the evaluation of the bid documents to fix the contract unit cost and let the contractor commence the construction.



### 3 CONSTRUCTION MANAGEMENT

#### 3.1 General

Construction management is conducted to ensure the safe and smooth implementation of specified work within a set period. As civil engineering work tends to be conducted for a relatively long time outdoors, it is not easy to fully predict all eventualities during the work period, i.e. changes of the weather, geological conditions and site conditions, etc., making it difficult to complete the work as originally planned. Moreover, the commencement of the work is often delayed by such external factors as the need to acquire land and to consult or coordinate with local interested parties, etc. As a result, it is often the case that the construction period needs to be shortened to compensate for the initial delay.

While the importance of securing the quality of earth work is increasing, there is a growing demand for rational as well as practical management through changes of the work system and labour saving.

There are two types of construction management.

- a. Work management : to manage the quality, schedule and cost which are essential components of construction work
- b. Site management : to manage machinery, labour, materials and safety at the site

In regard to work management, the management of a construction object, including its quality and dimensions, is commonly called quality control. In the case of civil engineering work, "quality control" usually means quality and excludes any reference to dimensions. Accordingly, quality control refers to quality which work piece control refers to dimensions.

Civil engineering work is commonly contracted out and, therefore, involves an owner and a contractor. The contents and key points of construction management for the owner differ from those for the contractor.

**Table 3-1 Construction Agreement**

Work Management	Schedule Control	Comparison between the planned schedule and the actual work progress
	Quality Control	Comparison between the original design and the actual quality achieved
	Completed Form Control	Comparison between the original design and the actual dimensions achieved
	Cost Control	Comparison between the contract value and the actual construction expenses
Site Management	Machine Control	Control of the machine operation and maintenance of the machine function, etc.
	Safety Control	Implementation and control of measures for work safety
	Environmental Conservation	Implementation of measures to prevent or alleviate noise, vibration and others caused by the work
	Others	Control of labour, materials and others

## **3.2 Schedule Control**

### **3.2.1 Schedule Control Technique**

It is not easy to proceed with and to complete the civil engineering work as planned. The work usually involves different types of work relating to crossing structures, retaining walls, drainage facilities and protection of embankment slope surfaces, etc. The disruption of any of these types of work can have a considerable impact on the progress of the entire work. Civil engineering work is also liable to disruption by water as the workability significantly fluctuates with the presence of water. The weather conditions also constitutes a strong factor which determines the work progress. Accordingly, careful schedule planning is required to ensure smooth work progress at the actual construction stage and constant comparison between the planned work process schedule and the actual progress is required.

The principal aim of schedule control is to ensure the smooth progress of the work in line with the originally planned work process schedule. If any delay occurs for one reason or another, it is essential to revise the subsequent work process schedule so that the work can continue based on the revised schedule.

Prior to the implementation of construction work, the work supervisor must establish a proper understanding of the following items in order to properly conduct the schedule control.

**a. Site Conditions**

To check whether or not the contents of the construction plan match the topography, geology, weather, labour, materials and other conditions of the site and also to check any work link with other structures related to the earth work at the site.

**b. Contract Conditions**

To check the contract conditions regarding any alteration of the site shape, change of work quantities, acquisition of the required land and consultation/coordination with local interested parties.

**c. Equipment Conditions**

To check the availability of sufficient capacities of equipment and to check the provision of sufficient safety measures regarding its use.

**d. Confirmation of Work Process Schedule**

To check the type(s) of work which mainly affects the work process schedule, likely bottlenecks and the available margin for delayed work in the work process schedule.

### **3.2.2 Response to Delay of Work Process Schedule**

When a delay occurs vis-a-vis the planned work process schedule, it is essential to identify the cause(s) of the delay by checking the following matters.

Was the commencement of the work delayed? Are the distribution and capacity of labour, materials and machinery sufficient?

Is there any problem in regard to the coordination of the order of

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implementation of various types of work?

- ˘ Is the weather, an accident or anything else responsible for the delay?
- ^ Is there any shortcoming in regard to the work implementation system and distribution of labour, etc.
- ˘ Is there any shortcoming in regard to the purchase arrangements for the materials?

The following measures should then be considered to rectify the situation.

Rearrangement of the order of the work

- ˘ Increase of the number of work teams to shorten the working hours
- ˘ Change of the machinery/equipment used
- ^ Examination of the work implementation system

In the case of a work delay caused by a problem of land, disaster or change of the site shape, etc., it is important for all interested parties to discuss the matter for the purpose of implementing the necessary measures.

### **3.3 Quality Control and Completed Form Control**

In general, it is difficult to rectify construction work defects when the defects are found during the completion inspection. It is, therefore, necessary to properly control the quality and completed amount at the construction stage so that the object of the work can pass the completion inspection without fail.

#### **3.3.1 Quality Control**

Quality control is a technique to economically create the object of the work, fully satisfying the quality standards indicated in the specifications. The main objectives of quality control are to perfect defective work, to minimise quality variations and to increase the reliability of the work.

Table 3-2 Examples of Quality Control Test Items for Roadbed

Category	Quality Characteristics	Testing/Measuring Methods	Remarks
Materials	<ul style="list-style-type: none"> <li>- Natural water content</li> <li>- Specific gravity of soil grain</li> <li>- Grain size</li> <li>- Liquid limit</li> <li>- Plastic limit</li> </ul>	<ul style="list-style-type: none"> <li>- Water content test of soil</li> <li>- Specific gravity test of soil grain</li> <li>- Mechanical analysis of soil</li> <li>- Liquid limit test of soil</li> <li>- Plasticity test of soil</li> </ul>	
Construction Work	<ul style="list-style-type: none"> <li>- Water content for construction work</li> <li>- Dry density</li> <li>- Soil pore rate</li> <li>- Degree of saturation</li> </ul>	<ul style="list-style-type: none"> <li>- Water content test of soil</li> <li>- Unit soil weight test at the site</li> </ul>	<p>To be conducted after rain or when a change of the water content is recognised</p> <p>To be conducted at a rate of one test per 1,000 m<sup>3</sup></p>

### 3.3.2 Confirmation of Quality

A work process schedule capacity chart and a histogramme, etc. prepared on the basis of the quality control test results are used to confirm that the construction materials meet the required quality standards. In addition, a work control chart is used to confirm the regular implementation of the work.

#### a. Work Process Schedule Capacity Chart

A work process schedule capacity chart uses the quality characteristic for the axis of ordinates and the sample number for the axis of abscissa to continually indicate the state of data fluctuation vis-a-vis the standard value by entering the measured values in the actual time sequence.

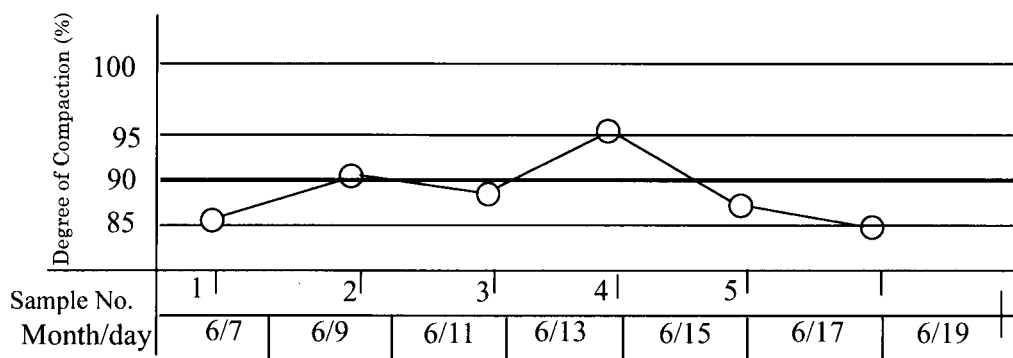


Figure 3-1 Example of Work Process Schedule Capacity Chart

#### b. Histogramme

A histogramme graphically represents the frequency distribution using the frequency for the axis of ordinates and the quality characteristic value for the axis of abscissa.

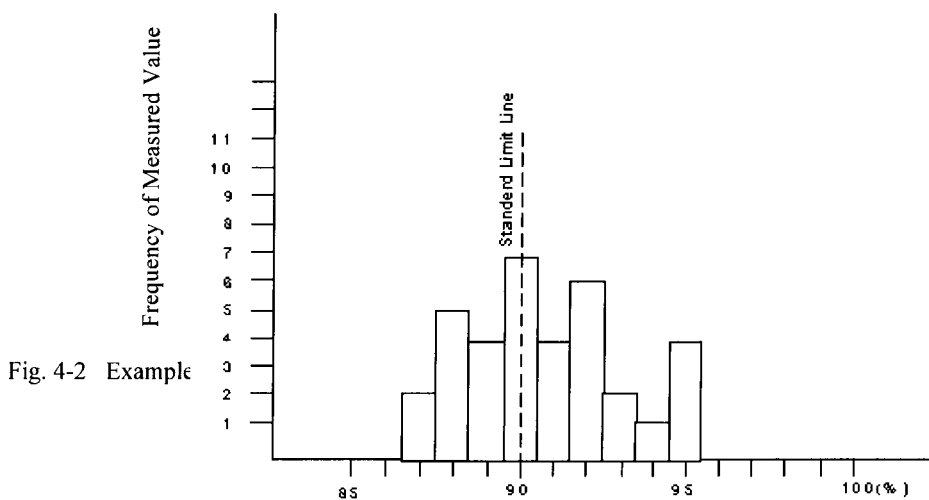


Fig. 4-2 Example

Figure 3.2 Example of Histogramme

### **3.3.3 Completed Form Control**

When any defect of a civil engineering structure is found after its completion, it is extremely difficult to conduct readjustment work. Because of this fact, it is important to control the completed form throughout the construction stage so that the object of the work meets the design requirements as well as the specifications.

#### **a. Completed Form of Earth Work**

The completed form relevant to earth work refers to the centre line, width, slope length, gradient and standard elevation. Special attention should be paid to any dislocation of the centre line, over-cutting of the slope surface and an insufficient banking width, etc.

#### **b. Concrete Structures**

In the case of concrete structures, special attention should be paid to dislocation, incorrect shape and incorrect dimensions, etc. Control work commences with inspection of the form dimensions prior to the placing of concrete.

#### **c. Subsidence Due to Soft Supporting Ground**

As subsidence due to soft supporting ground necessitates an increased amount of banking, it is necessary to estimate the likely amount of subsidence in advance.

#### **d. Drainage Facilities and Other Small Structures**

It is necessary to inspect the functions of drainage facilities and other small structures even if they are not specified in the design documents, etc.



### 3.3.4 Photographs of the Work

Photographs of the work constitute a work management component. Photographs are submitted together with various measurement data as records for completed form control after work completion and for the foundations of structures of which the conditions cannot be checked after work completion. Accordingly, photographs of the work must be taken in an appropriate manner to serve their intended purposes so that they can be used as useful work records.

Table 4-3 Examples of Photographs of the Work

Category	Type of Work	Subject Items for Photography
Prior to Work Commencement		General view of the most representative area(s)
Construction Work Commencement	Construction Work	General view or state of the work progress at the most representative area(s)
	Temporary Work	Materials used, state of temporary facilities, shape and dimensions
Safety Control	Safety Control	State of traffic control, including the installation of various signs and the deployment of safety control and security personnel
Quality Control	Material Tests	State of tests in progress
	Site Control and Tests	Measuring of the degree of compaction and bearing strength, etc.
Completed Form Control	Earth Work	State of the work and judgement on the soil type, etc.
	Slope Surface	Slope length and the degree of compaction
	Treatment of Soft Supporting Ground	Thickness of treatment work
	Water Supply and Drainage Channels	Width, height and thickness
Completion		General view of the most representative area(s)

### 3.4 Machine Control

Construction work is predominantly conducted by the use of machinery and the success or failure of the control of construction machinery/equipment significantly affects the work results. Machine control must be considered from the planning and design stages of the work and sufficient consideration must be given to all aspects of the work, including the selection of construction machinery/equipment and the planning of its use as well as maintenance. The crucial items for machine control are as follows.

#### a. Operation Control

As machinery expenses account for a large proportion of mechanised road construction work, constant efforts must be made to improve the operating rate and work efficiency of the construction machinery/equipment.

#### b. Maintenance of Construction Machinery/Equipment

For the systematic implementation of mechanised work, the machinery and

equipment must always be kept in good working order. To ensure this, regular checks, oiling and maintenance of the construction machinery/equipment must be conducted at the site.

### **3.5 Safety Control**

Completion of the work without any accidents is essentially the most economical way to end the work. Strengthening of the safety control through the consolidation of safety facilities and the strict enforcement of safe work is required together with improved awareness of the importance of safety control. Road work in particular is conducted in various locations with diverse combinations of construction machinery/equipment and often involves relatively unskilled workers. These characteristics of road work demand extra attention to work safety. Accidents are likely to be caused by the following.

- Mishandling of construction machinery/equipment
- Collapse of excavated sediment
- Falling or falling objects from a high place
- On-site traffic

More than half of fatal accidents involve construction machinery/equipment.

The damage caused by construction work may also involve local people, passers-by, houses and public facilities which are not directly related to the work. Careful attention must be paid to preventing any accidents to ensure smooth work progress.

### **3.6 Environmental Conservation Measures**

Construction work may have major adverse impacts on the living environment of the surrounding area because of noise, vibration, water contamination due to discharged sediment, scattered sediment and dust due to the transportation of soil, subsidence due to banking and the drying up of the groundwater supply due to cutting, etc. The prevention or minimisation of such adverse impacts must be taken into careful consideration at the time of conducting construction work. Moreover, environmental conservation laws and regulations which are relevant to the site must be checked and abided by.

### **3.7 Inspection**

#### **3.7.1 General**

Inspection means the checking of the conformity of partially or fully completed work with the specific requirements in the contract by means of visual observation, measuring and/or testing with a view to making a judgement of pass or failure. As civil engineering work is mainly conducted in the form of contracted work, work inspection is carried out to guarantee the completed form and the quality of the object of the contractor agreement.

On his part, the contractor conducts in-house inspection to verify the completion of the form and the quality of the object of the work to fully satisfy the owner while the owner must confirm the completion of a structure which meets the purpose of the work. There are two types of inspection, i.e. that referring to such elements of the completed form as the location, height, width and length and that referring to such qualitative aspects as the

degree of compaction of the banking, etc. The judgement criteria are included in the contract documents.

The work supervisor is required to make the necessary preparations, including the preparation of reference materials to assist the inspection and preliminary inspection of the work site, prior to the completion inspection in view of smoothly and properly conducting the completion inspection and handing over.

### **3.7.2 Inspection Methods**

#### **a. Completed Form Inspection Method**

The subject items of the completed form inspection include the locations of banking, cutting and structures, standard elevation, length and amount of soil. Measuring is conducted at selected representative points reflecting changes of the lateral alignment and vertical alignment instead of measuring all points.

#### **b. Quality Inspection Method**

Quality inspection is conducted by the owner using the reference materials submitted by the contractor in accordance with the specifications.

### **3.7.3 Acceptability Judgement Method**

Judgement of the acceptability of the completed work at the time of the completion inspection is based on whether or not any error of the completed object of the work is within the range which does not cause any problems in regard to the expected functions of the structure in question.

As the range of allowable error is determined based on the function, workability and economy of each work section, it varies depending on the character, contents and conditions of each type of work. In the case of earth work, such a range is usually determined on the basis of past work results, except in special cases. The judgement criteria must be given in the specifications, etc. and should constitute part of the contract conditions.